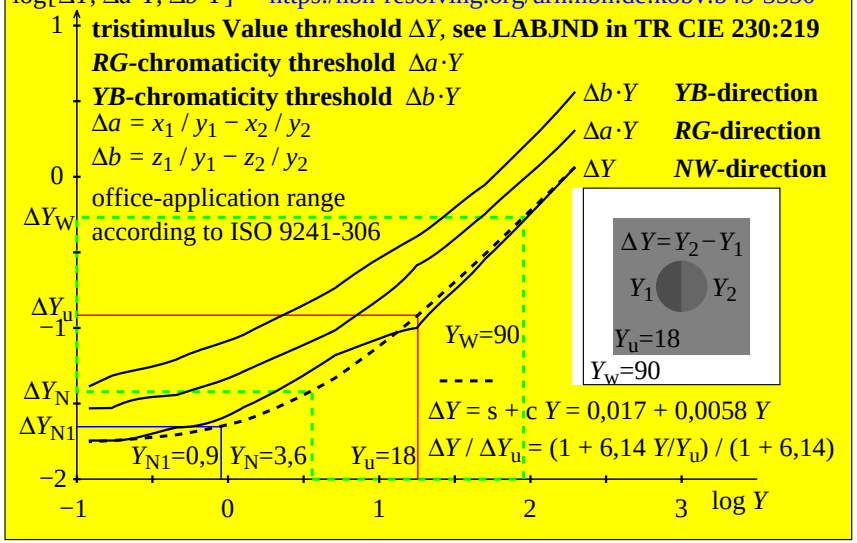
NW-achromatic, and *RG*- and *YB*-chromatic thresholds as function of *Y*

experiments and data: BAM-research report no. 115 (1985), page 72, see
log[ΔY, $\Delta a \cdot Y$, $\Delta b \cdot Y$] https:/nbn-resolving.org/urn:nbn:de:kobv:b43-3350



eeg10−3n eej10−7n

Colour-difference formula LABJND 1985 (JND=just noticeable difference)

$\Delta E^*_{JND} = \Delta E^*_{85} = A_0 [(\Delta Y)^2 + (A_3 \Delta a'' \cdot Y)^2 + (A_4 \Delta b'' \cdot Y)^2]^{1/2} / (A_1 + A_2 \cdot Y)$ [1]

$a = x / y$ $a_n = x_n / y_n$ $b = -0{,}4\, z / y$ $b_n = -0{,}4\, z_n / y_n$ [2]

$a'' = a_n + (a - a_n) / (1 + 0{,}5 \, | a - a_n |)$ n = D65 or A (background) [3]

$b'' = b_n + (b - b_n) / (1 + 0{,}5 \, | b - b_n |)$ [4]

$Y = (Y_1 + Y_2) / 2$ $\Delta Y = Y_1 - Y_2$ $\Delta a'' = a''_1 - a''_2$ $\Delta b'' = b''_1 - b''_2$ [5]

$A_1 = 0{,}0170$ $A_2 = 0{,}0058$ [6]

$A_3 = 1{,}0$ $A_4 = 1{,}8$ $A_0 = 1{,}5$ background D65 [7]

$A_3 = 1{,}0$ $A_4 = 1{,}7$ $A_0 = 1{,}0$ background A [8]

Just noticeable difference (JND) in four colour directions

$\Delta Y = \text{const} \, (A_1 + A_2 \cdot Y) / A_0$ in luminance direction *WN* [1a]

$\Delta a'' \cdot Y = \text{const} \, (A_1 + A_2 \cdot Y) / (A_0 \cdot A_3)$ in chromaticity direction *RG* [2a]

$\Delta b'' \cdot Y = \text{const} \, (A_1 + A_2 \cdot Y) / (A_0 \cdot A_4)$ in chromaticity direction *YB* [3a]

$\Delta c_{ab}'' \cdot Y = \text{const} \, (A_1 + A_2 \cdot Y) / (A_0 \cdot [A_3^2 + A_4^2]^{1/2})$ in chromaticity direction c_{ab} [4a]

eeg11−3n CEA21−3N

Colour-difference formula LABJND 1985 for near achromatic colours

$\Delta E^*_{JND} = \Delta E^*_{85} = A_0 [(\Delta Y)^2 + (A_3 \Delta a \cdot Y)^2 + (A_4 \Delta b \cdot Y)^2]^{1/2} / (A_1 + A_2 \cdot Y)$ [1]

$a = x / y$ $b = -0{,}4\, z / y$ [2]

$Y = (Y_1 + Y_2) / 2$ $\Delta Y = Y_1 - Y_2$ $\Delta a = a_1 - a_2$ $\Delta b = b_1 - b_2$ [3]

$A_1 = 0{,}0170$ $A_2 = 0{,}0058$ [4]

$A_3 = 1{,}0$ $A_4 = 1{,}8$ $A_0 = 1{,}5$ background D65 [5]

$A_3 = 1{,}0$ $A_4 = 1{,}7$ $A_0 = 1{,}0$ background A [6]

Just noticeable difference (JND) in three colour directions and line elements

$A_0 \cdot \Delta Y = (A_1 + A_2 \cdot Y)$ in luminance direction *WN* [1a]

$A_0 \cdot \Delta a \cdot A_3 \cdot Y = (A_1 + A_2 \cdot Y)$ in chromaticity direction *RG* [2a]

$A_0 \cdot \Delta b \cdot A_4 \cdot Y = (A_1 + A_2 \cdot Y)$ in chromaticity direction *YB* [3a]

$dE^*_{85,L} = \frac{\delta}{\delta Y} L^*_{85} = \frac{\delta}{\delta Y} [(A_0 / A_2) \cdot ln (A_1 + A_2 \cdot Y)] = A_0 \cdot dY / (A_1 + A_2 \cdot Y)$ [4a]

$dE^*_{85,a} = \frac{\delta}{\delta a} a^*_{85} = \frac{\delta}{\delta a} [(A_0 \cdot A_3 \cdot Y \cdot a) / (A_1 + A_2 \cdot Y)] = A_0 \cdot da \cdot A_3 \cdot Y / (A_1 + A_2 \cdot Y)$ [5a]

$dE^*_{85,b} = \frac{\delta}{\delta b} b^*_{85} = \frac{\delta}{\delta b} [(A_0 \cdot A_4 \cdot Y \cdot b) / (A_1 + A_2 \cdot Y)] = A_0 \cdot db \cdot A_4 \cdot Y / (A_1 + A_2 \cdot Y)$ [6a]

eeg10−7n CEA21−7n

Colour-difference formula TUBJND 2023 (JND=just noticeable difference)

$\Delta E^*_{JND} = \Delta E^*_{22} = A_0 [(\Delta Y_r)^2 + (A_3 \Delta a \cdot Y_{rc})^2 + (A_4 \Delta b \cdot Y_{rc})^2]^{1/2} / (A_1 + A_2 \cdot Y_r)$ [1]

$a = (x - x_c) / y$, $a_n = (x_n - x_c) / y_n$, $b = -0{,}4 B_c z / y$, $b_n = -0{,}4 B_c z_n / y_n$, $x_c = 0{,}11$ [2]

$c_{ab} = [(a - a_n)^2 + (b - b_n)^2]^{1/2}$, $Y_r = Y / Y_u$, $Y_u = 18$: tristimulus value of grey [3]

$Y_{rc} = Y_r - (c_{ab} / c_{ab,O})(Y_r - Y_{r,O})$ $c_{ab,O}$, $Y_{r,O}$: *Ostwald* chromaticity and Y_r [4]

$Y_r = (Y_{r1} + Y_{r2}) / 2$ $\Delta Y_r = Y_{r1} - Y_{r2}$ Y_r: relative tristimulus value [5]

$A_1 = 0{,}0170 \cdot Y_u$ $A_2 = 0{,}0058 \cdot Y_u$ $B_c = 0{,}8$ (D65), 1 (D50), 2,5 (A) [6]

$A_3 = 1{,}0 \cdot Y_u$ $A_4 = 1{,}8 \cdot Y_u$ $A_0 = 1{,}5 \cdot Y_u$ background D65 [7]

$A_3 = 1{,}0 \cdot Y_u$ $A_4 = 1{,}7 \cdot Y_u$ $A_0 = 1{,}0 \cdot Y_u$ background A [8]

Just noticeable difference (JND) in four colour directions

$\Delta Y_r = \text{const} \, (A_1 + A_2 \cdot Y_r) / A_0$ in luminance direction *WN* [1a]

$\Delta a \cdot Y_{rc} = \text{const} \, (A_1 + A_2 \cdot Y_{rc}) / (A_0 \cdot A_3)$ in chromaticity direction *RG* [2a]

$\Delta b \cdot Y_{rc} = \text{const} \, (A_1 + A_2 \cdot Y_{rc}) / (A_0 \cdot A_4)$ in chromaticity direction *YB* [3a]

$\Delta c_{ab} Y_{rc} = \text{const} \, (A_1 + A_2 \cdot Y_{rc}) / (A_0 [A_3^2 + A_4^2]^{1/2})$ in chromaticity direction c_{ab} [4a]

eeg11−7n